Makara Journal of Technology

Volume 27 | Issue 2 Article 1

8-30-2023

Investigating the Resistance Properties of Concrete Containing Waste Carpet Fibers

Faezeh Nejati
Ayandegan Institute of Higher Education, Tonekabon 4681853617, Iran, civilifa_nj@yahoo.com

Ali Mahboobi
Ayandegan Institute of Higher Education, Tonekabon 4681853617, Iran

Recommended Citation
Nejati, Faezeh and Mahboobi, Ali (2023) "Investigating the Resistance Properties of Concrete Containing Waste Carpet Fibers," *Makara Journal of Technology*: Vol. 27: Iss. 2, Article 1.
DOI: 10.7454/mst.v27i2.1616
Available at: https://scholarhub.ui.ac.id/mjt/vol27/iss2/1

Makara J. Technol. 27/2 (2023), 41–50
doi: 10.7454/mst.v27i2.1616

Investigating the Resistance Properties of Concrete Containing Waste Carpet Fibers

Faezeh Nejati* and Ali Mahboobi

Ayandegan Institute of Higher Education, Tonekabon 4681853617, Iran

*E-mail: civilifa_nj@yahoo.com

Abstract

This research was conducted with the aim of investigating the use of waste carpet fiber (WCF) and assessing the resistance properties of concrete. The main goal of this study was to investigate the effect of the internal processing of concrete containing WCF on increasing its resistance properties. At the same time, the secondary goals pursued in the research included determining the optimal percentages of carpet fibers in improving compressive strength, tensile strength, and bending strength. The materials used included cement, aggregates, water, WCF, and super lubricant. This research applied seven mixing designs: A, B1, B2, C1, C2, D1, and D2. Mixing plan A was the control plan. Sample B1 contained 2.45 kg/m^3 of WCF and 40 kg/m^3 of lyca for processing, while sample B2 contained 2.45 kg/m^3 of WCF and no lyca. Sample C1 contained 35.7 kg/m^3 of WCF and 80 kg/m^3 of lyca for processing, sample C2 contained 35.7 kg/m^3 of WCF and no lyca, Sample D1 contained 12.25 kg/m^3 of WCF and 120 kg/m^3 of lyca for processing, and sample D2 contained 12.25 kg/m^3 of WCF and no lyca. The results showed that the use of waste carpet fibers and processing by lyca reduced the compressive strength of the samples. The results of the tensile strength test revealed that the use of waste carpet fibers along with processing by lyca increased the tensile strength of the samples. Finally, the flexural strength test results showed that the use of small amounts of WCF and lyca treatment led to an increase in the flexural strength of concrete.

Keywords: carpet, lyca, resistance, waste fibers

1. Introduction

Builders have recommended the ideal compressive strength of 15–20 MPa. Thus, since the mid-1960s, concrete was used as the most economical and safest material to build low-height structures. During that period, the replacement of concrete instead of steel in the construction of high-rise structures was not included in engineers' plans. At that time, concrete was used in tall structures as a layer to protect steel sections against fire. Over the years, researchers have attempted to provide new methods in the field of construction, and the results of these efforts can be found in the city of Chicago in the 1960s, followed by the widespread use of high-strength concrete in the main structures. By the 1970s, the use of compressive strength of concrete in the construction of columns of buildings higher than the common one increased considerably. For context, this issue involved a situation wherein they did not have the ability to build such a structure and concrete with the standard criteria of that time. In 1992, many studies have been conducted regarding the description and definition of high resistance. Since then, the use of high-performance concrete has expanded greatly. Thus far, it has caused many researchers to try to make concrete with other properties and until now, the use and production of different types of concrete with different capabilities, such as concrete with high efficiency and durability, light weight, heat insulation, and low creep and shrinkage, has increased [1].

Abdul Awl and Mohammad Hosseini investigated the production of green concrete by combining ash from burning palm oil and waste carpet, thus reaching several conclusions [2]. First, they found that adding carpet fibers in concrete reduces its efficiency. Furthermore, the higher the volume of fibers, the lower the amount of slump. They also found that the compressive strength of the mixture containing fibers decreased with increasing fiber content. Finally, despite the lower growth in compressive strength, there was a significant increase in tensile and bending strength values.

In an article entitled "Impact resistance and mechanical properties of concrete reinforced with waste polypropylene carpet fibers," Mohammad Hosseini *et al*. examined the effects of polypropylene carpet fibers in different volume ratios between 0.25% and 1.25% on compressive strength as well as on tensile, bending, and impact resistance. After testing concrete containing 50% ash from burning palm oil, they found that as the fibers increased, the efficiency value decreased, the compressive strength decreased, and the tensile and bending strength values increased. In addition, their results revealed that adding waste carpet fibers led to the improvement of impact resistance and energy absorption capacity of fiber-reinforced concrete [3-5].

Farzadenia *et al*. investigated the effects of internal processing with premoistened lyca on the shrinkage and resistance properties of concrete containing WCF. Their research indicated good results of all designs in terms of reducing the amount of spontaneous shrinkage and increasing the strength characteristics of concrete. Furthermore, the results of compressive and tensile strength tests revealed that the design containing 10% premoistened lyca produced a better product [6].

In his research, Bantia discussed the parameters affecting the compressive strength of concrete containing carpet fibers. He concluded that the shape, optimal percentage, volume and apparent ratio of WCF all have great impacts on improving the resistance properties [7]. In 2021, Alabduljabbar *et al*. investigated the production of green and sustainable concrete using WCF in 365 days and found that the compressive strength of the resulting product ranged within 43–54 MPa. Therefore, the incorporation of WCF increased the concrete's tensile and flexural strength. Furthermore, the results of their study showed the potential application of using industrial waste carpet fiber as a structural component in the production of green concrete [8].

In 2023, Bakde *et al*. studied the effects of fibers and waste materials on stable concrete and found that waste materials and fibers simultaneously increased the concrete's mechanical strength and resistance to sulfate and acid attack. They also suggested the conduct of further research on the use of waste materials and fiber-based construction materials [9].

2. Cases and Methods

Specifications of Materials

Cement. In this research, cement type 2 of Mazandaran cement factory was used.

Water. The water used in the construction of the mixing plan was taken from the drinking water of Tankabon City. Its pH level was around 7.5, and its chloride ion concentration was 0.0134%.

Super lubricant. The polycarboxylate-type super lubricant used to maintain efficiency, prevent porosity, and create proper homogeneity of the mixture was modified from the third generation of super lubricants.

Characteristics of used fibers. The fibers used in this project were recycled scrap carpets made of acrylic and polyester materials. Figures 1 and 2 present images od polyester and acrylic waste fibers, respectively. Tables 1 and 2 present the characteristics of polyester waste fibers, and acrylic waste fibers, respectively.

Figure 1. Polyester Waste Fibers

Figure 2. Acrylic Waste Fibers

Table 1. Characteristics of used Polyester Waste Fibers

Type of Fiber	Length (mm)	Diameter (mm)	Density (Kg/m^3)	Tensile Strength (MPa)	Melting Point (C)	Reaction with Water
Multidisciplinary	30	3.5	880	58	240	**Hydrophilic**

Table 2. Specifications of Acrylic Waste Fibers

Type of Fiber	Length (mm)	Diameter (mm)	Density (Kg/m^3)	Tensile Strength (MPa)	Melting Point (C)	Reaction with Water
Multidisciplinary	30	4.5	980	52.3	257	**Hydrophilic**

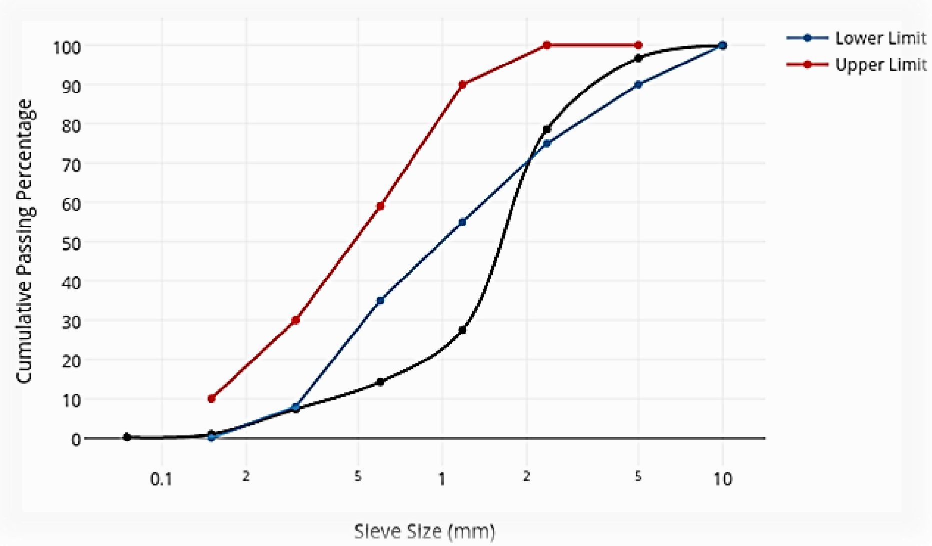

Figure 3. Granulation Curves of the Stone Materials

Table 3. Details of the Concrete Mixing Plan

Sample Name	Volume of WCF (kg/m^3)	Sand (kg/m^3)	Pea Gravel (kg/m^3)	Almond Sand (kg/m^3)	Water (kg/m^3)	Cement (kg/m^3)	W/C	Lyca kg/m^3
A	0	1026	428	257	190	346	0.55	**-**
B1	2.45	1022	426	256	190	346	0.55	**40**
B2	2.45	1022	426	256	190	346	0.55	**-**
C1	7.35	1015	423	254	190	346	0.55	**80**
C2	7.35	1015	423	254	190	346	0.55	**-**
D1	12.25	1007	420	252	190	346	0.55	**120**
D2	12.25	1007	420	252	190	346	0.55	**-**

Aggregate. The aggregates used in this research consisted of two parts coarse grain and fine. The granulation curve of the used sand is shown in Figure 3.

Mixing plan. The mixing plan refers to the process of determining the ratio of concrete components in such a way that the resulting concrete is as economical as possible and meets the required requirements [10]. Among these requirements, the efficiency, durability, and compressive strength of concrete can be mentioned. Table 3 shows the details of the mixing scheme.

3. Analysis of the Results

Compressive strength of experimental results. In this study, the compressive strength test was performed on the manufactured cubic samples. Table 4 presents the compressive strength test results for the samples of seven mixing plans at the ages of 7, 14, 28, and 42 days.

Figure 4 compares the compressive strengths of the samples made at the age of 7 days. Sample A is considered the control sample. In samples B1 and B2, 2.45 kg of

WCF were used, sample B1 was processed by Lyca, and sample B2 was not processed. The results for this sample revealed that the use of waste carpet fibers reduced compressive strength by 11% to compensate for this decrease. Compressive strength decreased by about 6% compared with sample (B2), which was compensated (B1). In general, the use of 2.45 kg/m^3 of WCF reduced the compressive strength of all samples by 11%, and processing with the help of lyca compensated for this loss of compressive strength by 6%. In samples C1 and C2, it contains 7.35 kg/m^3 of WCF. Sample C1 was processed by Lyca, while sample C2 did not undergo processing. The results for C2 showed that the use of waste carpet fibers reduced compressive strength by 15%. To compensate for this decrease, the same sample (C2) was subjected to processing by Lyca, and the resulting compressive strength in the processing conditions increased by up to 5.4% compared with sample (B2) that was compensated (B1). In general, the use of 7.35 kg/m^3 of WCF reduced the compressive strength of the samples by 15%, and processing with the help of lyca compensated for this loss of compressive strength by 5.4%.

Samples D1 and D2 contained 12.25 kg/m^3 of WCF. Sample D1 was processed by Lyca, and sample D2 did not undergo processing. The results for this sample showed that the use of waste carpet fibers reduced compressive strength by 22%. To compensate for this decrease, the same sample (D2) was subjected to processing by Lyca, and the resulting compressive strength in the processing conditions increased by up to 7.4% compared with sample (D2) that was compensated (D1). In general, the use of 12.25 kg/m^3 of WCF reduced the compressive strength of the samples by 22%, and processing with the help of lyca compensated for this loss of compressive strength by 7.4%.

Figure 5 compares the compressive strengths of the samples made at the age of 14 days. Sample A was the control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results for this sample showed that the use of waste carpet fibers reduced compressive strength by 9%. To compensate for this decrease in compressive strength, the same sample (B2) was subjected to processing by Lyca and the resulting compressive strength in the processing conditions increased by up to 2.5% compared with the sample (B2) that was compensated (B1). In general, the use of 2.45 kg/m^3 of WCF reduced the compressive strength of the samples by 9% at the age of 14 days, and this reduction in compressive strength was treated with

Table 4. Compressive Strength Test Results for the Samples of Seven Mixing Plans at the Ages of 7, 14, 28 and 42 Days

Specimen	7 Days	14 Days	28 Days	42 Days
A	45	55	62	**65**
B1	43	52.1	59.2	**63.1**
B2	40	49.6	56.6	**58**
C1	40.4	52.1	59.3	**60.1**
C2	38.2	47.9	56.1	**57.2**
D1	38.3	49.2	50.1	**57.3**
D2	35.2	46.6	47	**55.5**

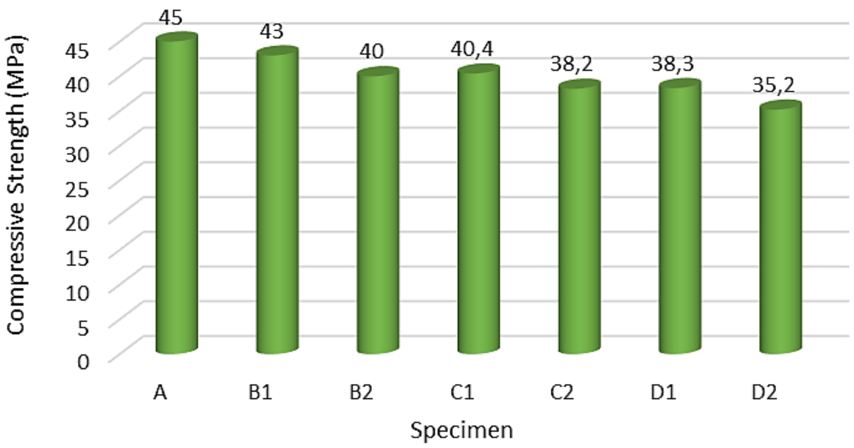

Figure 4. Comparison of the Compressive Strength of the Samples Made at the Age of 7 Days

the help of Lyca, which can compensate by up to 2.5%. Samples C1 and C2 contained 7.35 kg/m^3 of WCF. Sample C1 was processed by Lyca, and sample C2 had no processing. The results for this sample showed that the use of WCF reduced compressive strength by 12%. To compensate for this decrease, the same sample (C2) was subjected to processing by Lyca, and the resulting compressive strength in the processing conditions increased by up to 2.5% compared with the sample (C2) that was compensated (C1). In general, the use of 7.35 kg/m^3 of WCF reduced the compressive strength of the samples by 12% at the age of 14 days, and processing with the help of Lyca compensated for this loss of compressive strength by 5.2%.

Samples D1 and D2 contained 25 12 kg/m^3 of waste carpet fibers. Sample D1 was processed by Lyca, and sample D2 has no processing. The results for this sample showed that the use of waste carpet fibers reduced compressive strength by 15% at the age of 14 days. To compensate for this reduction, the same sample (D2) was processed by Lyca, and the resulting compressive strength in the processing conditions was compensated by up to 10.4% compared with the other samples, namely, (D2) and (D1). In general, the use of 12.25 kg/m^3 of WCF caused a 15% decrease in the compressive strength of the samples at the age of 14 days, and processing with the help of lyca compensated for this decrease in compressive strength by 10.4%.

Figure 6 compares the compressive strength of the samples made at the age of 28 days. Sample A was the control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results for this sample showed that the use of waste carpet fibers reduced the 28-day compressive strength by 8.7%. To compensate for such a reduction, the same sample (B2) was subjected to processing by Lyca, and the resulting compressive strength in the processing conditions was compensated by up to 4.2% compared with the samples, namely, (B2) and (B1). In general, the use of 2.45 kg/m^3 of WCF reduced the compressive strength of the samples by 8.7% at the age of 28 days, and processing with the help of lyca compensated for this loss of compressive strength by 4.2%.

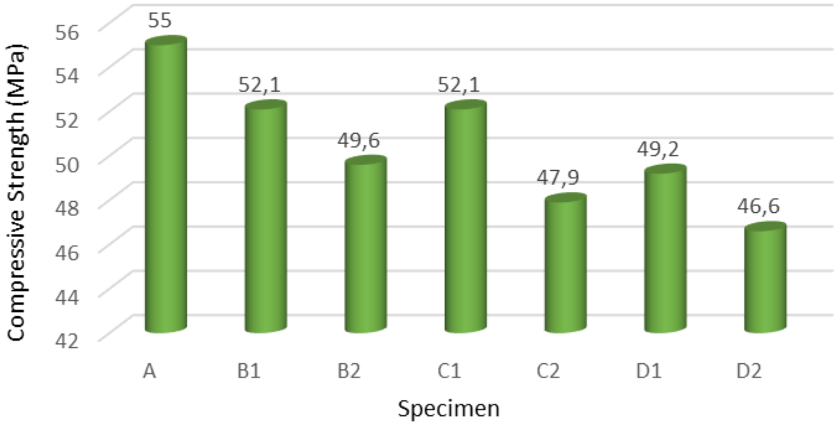

Figure 5. Comparison of the Compressive Strength of the Samples Made at the Age of 14 Days

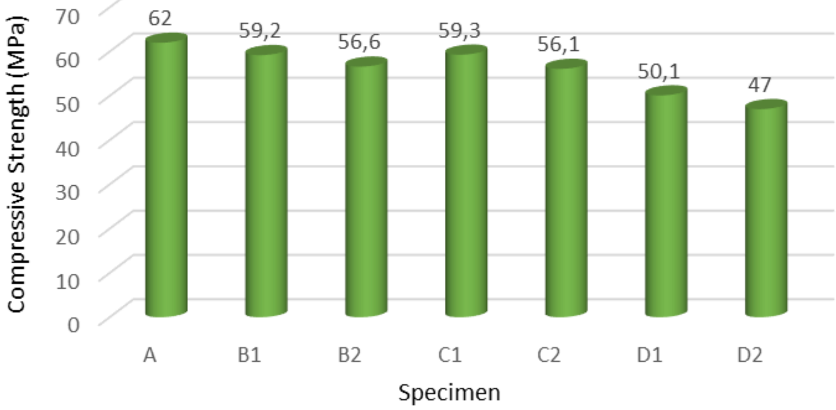

Figure 6. Comparison of the Compressive Strength of the Samples Made at the Age of 28 Days

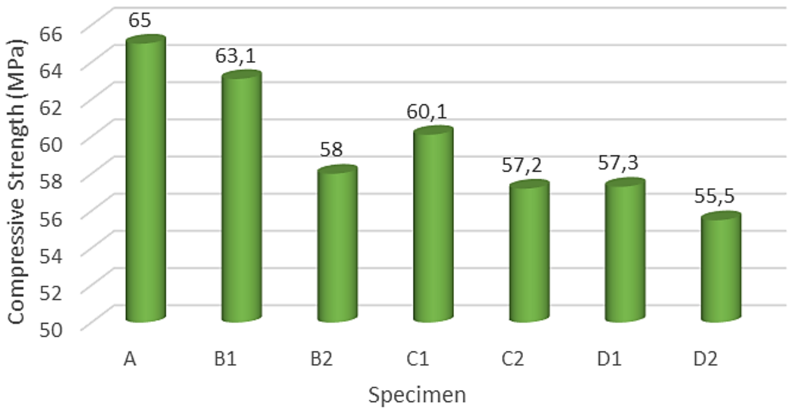

Figure 7. Comparison of the Compressive Strength of the Samples Made at the Age of 42 Days

Samples C1 and C2 contained 7.35 kg/m^3 of WCF. Sample C1 was processed by Lyca, and sample C2 had no processing. The results for this sample showed that the use of waste carpet fibers reduced compressive strength by 9.5%. To compensate for this decrease in compressive strength, the same sample (C2) was subjected to processing by Lyca, and the resulting compressive strength in the operating conditions The yield was compensated by up to 2.5% compared with the other samples, namely, (C2) and (C1). In general, the use of 7.35 kg/m^3 of WCF reduced the compressive strength of the samples by 9.5% at the age of 28 days, and processing with the help of lyca compensated for this loss by 5.2%.

Samples D1 and D2 contained 12.25 kg/m^3 of WCF. Sample D1 was processed by Lyca, and sample D2 had no processing. The results for this sample showed that the use of waste carpet fibers reduced compressive strength by 24% at the age of 28 days. To compensate for this decrease, the same sample (D2) was processed by Lyca, and the resulting compressive strength in the processing conditions was compensated by up to 6.4% compared with the other samples, namely, (B2) and (B1). In general, the use of 12.25 kg/m^3 of WCF reduced the compressive strength of the samples by 15% at the age of 28 days, and processing with the help of lyca compensated for this loss of compressive strength by 6.4%.

Figure 7 compares the compressive strength of samples made at the age of 42 days. Sample A was the control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results for this sample showed that the use of waste carpet fibers reduced the 28-day compressive strength by 10%. To compensate for this reduction, the same sample (B2) was subjected to processing by Lyca, and the resulting compressive strength in the processing conditions was compensated by up to 8% compared with the other samples, namely, (B2) and (B1). In general, the use of 2.45 kg/m^3 of WCF reduced the compressive strength of the samples by 10% at the age of 42 days, and processing with the help of lyca compensated for this loss of compressive strength by 8%.

Samples C1 and C2 contained 7.35 kg/m^3 of WCF. Sample C1 was been processed by Lyca, and sample C2 did not undergo processing. The results for this sample showed that the use of WCF reduced compressive strength by 12%. To compensate for this decrease, the same sample (C2) was subjected to processing by Lyca, and the resulting compressive strength in the processing conditions increased by up to 4% compared with the sample (C2) that was compensated (C1). In general, the use of 7.35 kg/m^3 of WCF reduced the compressive strength of the samples by 12% at the age of 28 days, and processing with the help of lyca compensated for this loss of compressive strength by 4%.

Samples D1 and D2 contained 12.25 kg/m^3 of WCF. Sample D1 was been processed by Lyca, and sample D2 did not undergo processing. The results for this sample showed that the use of waste carpet fibers reduced compressive strength by 14% at the age of 42 days. To compensate for this decrease, the same sample (D2) was processed by Lyca, and the resulting compressive strength in the processing conditions was compensated by up to 6.4% compared with the other samples, namely, (B2) and (B1). In general, the use of 12.25 kg/m^3 of WCF reduced the compressive strength of the samples by 15% at the age of 42 days, and processing with the help of lyca compensated for this loss of compressive strength by 3.4%.

Tensile strength test results. The tensile strength test was performed on all samples at the ages of 7, 14, 28, and 42 days. The results are shown in Table 5.

Figure 8 compares the tensile strengths of the samples made at the age of 7 days. Sample A was the control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results showed that the use of waste carpet fibers increased the tensile strength by 8.3%. In sample B1, which was treated, the results revealed that the treatment caused the tensile strength to increase by 3% compared with the control design.

Sample A was the control sample. In samples C1 and C2, 7.35 kg of WCF were used, sample C1 was processed by Lyca, and sample C2 did not undergo processing. The results revealed that the use of waste carpet fibers increased tensile strength by 17.3%. In sample D1, which underwent processing, the results showed that the processing caused the tensile strength to increase by 9% compared with the control design.

Sample A was the control sample. In samples D1 and D2, 12.25 kg of WCF were used, sample D1 was processed by Lyca, and sample D2 did not undergo processing. The results revealed that the use of WCF increased tensile strength by 12%. In sample D1, which was treated, the results showed that the treatment caused the tensile strength to increase by 3% compared with the control design.

Figure 9 compares the tensile strength of the samples made at the age of 14 days. Sample A was the control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results revealed that the use of waste carpet fibers increased tensile strength by 8.5%. In sample B1, which was subjected to processing, the results showed that the processing caused the tensile strength to remain constant compared with the control design.

Table 5. Tensile Strength Test Results were Performed for Samples of Seven Mixing Plans at the Ages of 7, 14, 28 and 42 Days

Speciment	7 Days	14 Days	28 Days	42 Days
A	3.1	3.5	3.9	**4.3**
B1	3.2	3.5	4	**4.5**
B2	3.36	3.8	4.2	**4.7**
C1	3.4	3.6	4.2	**4.4**
C2	3.7	3.9	4.4	**4.7**
D1	3.2	3.3	3.9	**4.1**
D2	3.5	3.7	4.2	**4.4**

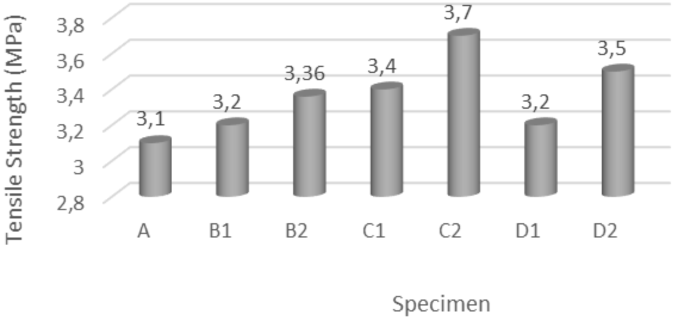

Figure 8. Comparison of the Tensile Strengths of the Samples Made at the Age of 7 Days

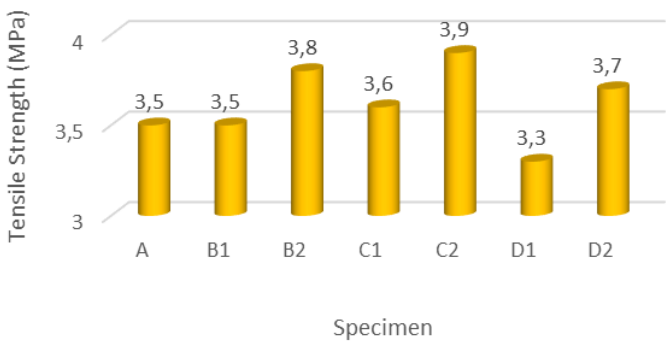

Figure 9. Comparison of the Tensile Strength of the Samples Made at the Age of 14 Days

Sample A was the control sample. In samples C1 and C2, 7.35 kg of WCF were used, sample C1 was processed by Lyca, and sample C2 did not undergo processing. The results indicated that the use of waste carpet fibers increased the tensile strength by 11.4%. In sample C1, which was treated, the results showed that the treatment caused the tensile strength to increase by 2% compared with the control design.

Sample A was again considered the control sample. In samples D1 and D2, 12.25 kg of WCF were used, sample D1 was processed by Lyca, and sample D2 did not undergo processing. The results revealed that the use of waste carpet fibers increased tensile strength by 5%. In sample D1, which was treated, the results showed that the treatment increased the tensile strength by 5% compared with the control design.

Figure 10 compares the tensile strength of the samples made at the age of 28 days. Sample A was the control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results showed that the use of waste carpet fibers increased tensile strength by 7.6%. In sample B1, which was treated, the results revealed that the treatment increased tensile strength by 2% compared with the control design.

Sample A was considered as a control sample. In samples C1 and C2, 7.35 kg of WCF were used, sample C1 was processed by Lyca, and sample C2. The results indicated that the use of waste carpet fibers increased the tensile strength by 12.8%. In sample C1, which was treated, the results revealed that the treatment increased tensile strength by 7% compared with the control design.

Sample A was considered as a control sample. In samples D1 and D2, 12.25 kg of WCF were used, sample D1 was processed by Lyca, and sample D2 did not undergo processing. The results showed that the use of waste carpet fibers increased tensile strength by 7.6%. In sample D1, which was subjected to treatment, the results indicated that the treatment decreased the tensile strength compared with the control sample.

Figure 11 compares the tensile strength of the samples made at the age of 42 days. Sample A was considered as a control sample. In samples B1 and B2, 2.45 kg of WCF were used, sample B1 was processed by Lyca, and sample B2 did not undergo processing. The results revealed that the use of waste carpet fibers increased tensile strength by 9.3%. In sample B1, which was treated, the results revealed that the treatment increased tensile strength by 4.6% compared with the control design.

Sample A was the control sample. In samples C1 and C2, 7.35 kg of WCF were used, sample C1 was processed by Lyca, and sample C2 did not undergo processing. The results indicated that the use of waste carpet fibers increased tensile strength by 9.3%. In sample C1, which was treated, the results revealed that the treatment increased tensile strength by 2% compared with the control design.

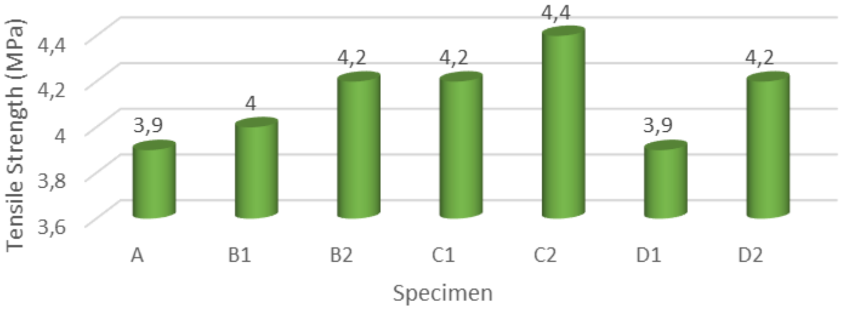

Figure 10. Comparison of the Tensile Strengths of the Samples Made at the Age of 28 Days

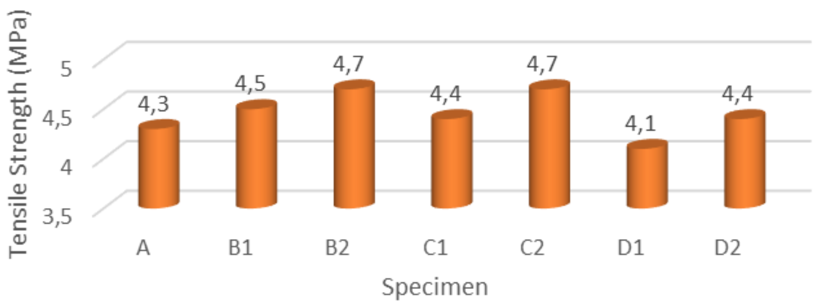

Figure 11. Comparison of the Tensile Strengths of the Samples Made at the Age of 42 Days

Table 6. Flexural Strength Test Results for the 42-day Samples

Specimen	42-day flexural strength
A	**7.79**
B1	**8.92**
B2	**8.27**
C1	**8.1**
C2	**7.76**
D1	**6.8**
D2	**6.23**

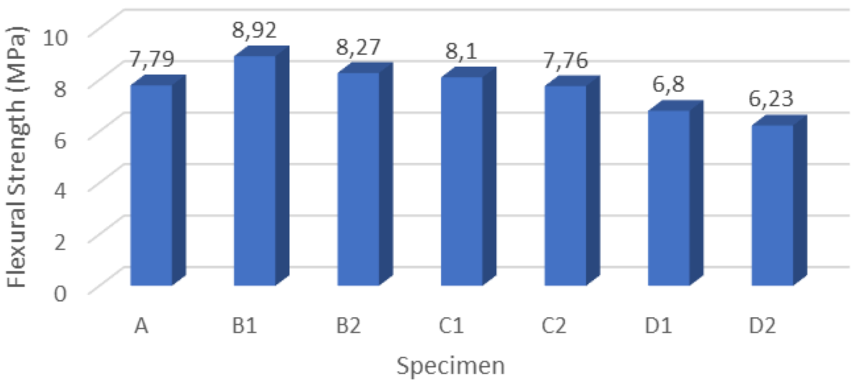

Figure 12. Flexural Strength Test Results for Samples at the Age of 42 Days

Finally, sample A was considered as a control sample. In samples D1 and D2, 12.25 kg of WCF were used, sample D1 was processed by Lyca, and sample D2 did not undergo processing. The results revealed that the use of waste carpet fibers increased tensile strength by 7.6%. In sample D1, which was subjected to treatment, the results indicated that the treatment decreased the tensile strength compared with the control sample.

Bending resistance test. The bending strength test was performed on the prism samples at the age of 42 days. The results are given in Table 6 and Figure 12.

4. Conclusions

The comparison of the compressive strengths of the 7-day samples shows that the use of WCF and processing with the help of Lyca decreased the samples' compressive strength compared with the control. The greatest reduction is in the use of WCF (12.25 kg/m^3) and 120 (kg/m^3) light grains have been obtained.

The comparison of the compressive strengths of the 14-day samples shows that the use of WCF and processing with the help of lyca decreased the samples' compressive strength compared with the control. The greatest reduction is in the use of WCF (12.25 kg/m^3) and 120 (kg/m^3) light grains have been obtained.

The comparison of the compressive strength of the 28-day samples shows that the use of WCF and processing with the help of lyca decreased the samples' compressive strength compared with the control, but this decrease is much less compared with the 7- and 14-day samples.

The comparison of the compressive strengths of the 42-day samples shows that the use of WCF and processing with the help of Lyca decreased the samples' compressive strength compared with the control. The greatest reduction is in the use of 12.25 (kg/m^3) WCF and (kg /m^3) 120 light grains of lyca have been obtained. The lowest amount of reduction in compressive strength is in sample B1 which has 45.2 kg/m^3 of waste carpet fibers and then processed with 40 kg/m^3 of lyca.

The comparison of the tensile strengths of the samples at the age of 7 days shows that the waste carpet fibers and processing by lyca increased the samples' tensile strength compared with the control sample. The highest percentage increase in the tensile strength is in sample C2, which contains 7.35 kg/m^3 of waste fiber. The grain style of lyca was not used in this sample.

The comparison of the tensile strengths of the samples at the age of 14 days shows that the waste carpet fibers and processing by lyca increased the tensile strength in all samples, except D1, compared with the control sample. The highest percentage increase in the tensile strength is in sample C2, which contains 35.7 kg/m^3 of waste carpet fibers. The grain style of lyca was not used in this sample.

The comparison of the tensile strengths of the samples at the age of 28 days shows that the waste carpet fibers and processing by lyca increased the samples' tensile strength compared with the control sample. The highest percentage increase in the tensile strength is in sample C2, which contains 7.35 kg/m^3 of waste carpet fiber. The style of lyca grain was not used in this sample.

The comparison of the tensile strengths of the samples at the age of 42 days shows that the waste carpet fibers and processing by lyca increases the samples' tensile strength compared with the control. The highest percentage increase in the tensile strength is in sample C2, which contains 7.35 kg/m^3 in waste fibers. The style of lyca grain was not used in this sample.

The results of the bending strength test at the age of 42 days show that the highest percentage increase in bending strength is achieved when 2.45 kg/m^3 of WCF and 40 kg/m^3 of lyca are used for processing.

In general, we arrive at the following conclusions: a) The compressive strength of the concrete mixture at all ages decreases with the increase in the content of recycled carpet fibers; b) Despite the decrease in compressive strength upon using WCF, a significant increase in tensile strength values has been observed; c) The use of 2.25 kg of WCF has increased bending strength compared with the control sample.

References

[1] N.P. Tran, C. Gunasekara, D.W. Law, S. Houshyar, S. Setunge, ACI Mater. J. 119/4 (2022) 125.
[2] A.A. Awal, H. Mohammadhosseini, J. Cleaner Prod. 137 (2016) 157.
[3] H. Mohammadhosseini, M.M. Tahir, A.R.M. Sam, N.H.A.S. Lim, M. Samadi, J. Cleaner Prod. 185 (2018) 252.
[4] H. Mohammadhosseini, R. Alyousef, N.H.A.S. Lim, M.M. Tahir, H. Alabduljabbar, A.M. Mohamed, J. Build. Eng. 30 (2020) 101250.
[5] H. Mohammadhosseini, M.M. Tahir, A. Alaskar, H. Alabduljabbar, R. Alyousef, J. Build. Eng. 27 (2020) 101003.
[6] M.S. Farzadniya, M.N. Abou-Zeid, Resilient Infr. (2019) 1.
[7] N. Banthia, N. Nandakumar, Cem. Conc. Compos. 25/1 (2003) 3.
[8] H. Alabduljabbar, H. Mohammadhosseini, M.M. Tahir, R. Alyousef, Mater. Today Proc. 39/2 92021) 929.
[9] S. Bakde, P. Suryawanshi, S. Murkute, R. Bharti, S.K. Shaw, H.A. Khan, Mater. Today Proc. (2023).
[10] K.J. Folliard, N.S. Berke, Cem. Conc. Res. 27/9 (1997) 1357.